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1. AGENCY USE ONLY (Leave blank)	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	20 Sep 95	

4. TITLE AND SUBTITLE
Incidence of Intraoperative Recall With Preoperative Suggestion

5. FUNDING NUMBERS

6. AUTHOR(S)
Freddie White

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
AFIT Students Attending:
University of Tennessee

8. PERFORMING ORGANIZATION REPORT NUMBER
95-084

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)
DEPARTMENT OF THE AIR FORCE
AFIT/CI
2950 P STREET, BLDG 125
WRIGHT-PATTERSON AFB OH 45433-7765

10. SPONSORING/MONITORING AGENCY REPORT NUMBER

DTIC ELECTE OCT 2 3 1995 S D G

11. SUPPLEMENTARY NOTES

12a. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for Public Release IAW AFR 190-1
Distribution Unlimited
BRIAN D. GAUTHIER, MSgt, USAF
Chief of Administration

12b. DISTRIBUTION CODE

13. ABSTRACT *(Maximum 200 words)*

19951019 134

DTIC QUALITY INSPECTED 5

14. SUBJECT TERMS

15. NUMBER OF PAGES
55

16. PRICE CODE

17. SECURITY CLASSIFICATION OF REPORT	18. SECURITY CLASSIFICATION OF THIS PAGE	19. SECURITY CLASSIFICATION OF ABSTRACT	20. LIMITATION OF ABSTRACT

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Incidence of Intraoperative Recall with Preoperative Suggestion

A Thesis Presented

to the Faculty of the

College of Nursing

of

The University of Tennessee, Memphis

In Partial Fulfillment

of the Requirements for the

Degree Master of Science in Nursing

from the University of Tennessee

by

Freddie White

December 1995

Accesion For
NTIS CRA&I [X]
DTIC TAB [ ]
Unannounced [ ]
Justification
By
Distribution /
Availability Codes
Dist | Avail and / or Special
A-1

Abstract

Although rare, reports of recall of intraoperative events continue to occur during general anesthesia. The purpose of this pilot study was to attempt to prompt recall in subjects undergoing general anesthesia (GA) by presenting the subject a pleasant preoperative suggestion. An experimental study was conducted on a convenience sample of 14 patients, ASA class I or II, aged 20-65, admitted to the University of Tennessee Medical Center for general surgery. Patients will be randomly assigned to a control group or an experimental group, the experimental group receiving the preoperative suggestion. Exclusion criteria included patients requiring preoperative medication with benzodiazepines, use of psychotropic drugs, substance abuse, or those with mental or organic brain diseases. Procedures under 30 minutes and intracranial procedures were also excluded. Anesthetic technique was uniform for both the experimental and control group. No aspect of drug or patient care was randomized, all patients received a standard, non-experimental anesthetic technique. Anesthesia was induced with propofol 2.5 mg/kg and maintained with N2O and isoflurane. Maintenance doses of fentanyl 50 mcg/kg were administered as needed for analgesia. Data was collected and measured in a postoperative interview, in which patients

were questioned about intraoperative recall. Statistical analysis was not done due to no reports of dreaming or recall from either group. No correlations existed. Means and standard deviations were given for each group and showed no significant differences in the groups age or anesthetic time. Failure to produce significant results should not discourage anesthesia personnel from seeking ways to make the surgical experience less stressful. In doing so there may be a decrease in postoperative recovery time, analgesia requirements, and hospital costs. Through use of a preoperative suggestion, the anesthetist attempts to give the patient a method of selectively using recall to their own benefit and allowing the patient to participate in enhancement of the recovery period.

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CHAPTER 1

Introduction

Anesthesia as it is known today is divided into four concepts; analgesia, autonomic control, amnesia, and muscle relaxation. Assurance of amnesia and analgesia are usually paramount in the patients hierarchy of needs. Historically, awareness under general anesthesia has been a concern of the provider of anesthesia. Since the first published administration of surgical anesthesia at Massachussetts General Hospital in 1846 by T.G. Morton, (Bankert, 1993) attempts have been made to limit recall of events taking place during the operative period.

Recall under general anesthesia has been described as emotionally traumatic to the person being anesthetized (Waugaman, 1992 p.433). Personal interviews reveal the terror experienced by the patient having recall (Grunchaw 1990; Moerman, Bonke, and Oosting, 1993). The incidence of recall has been reported to occur at varying degrees during the past several years. Lyons and MacDonald, (1991) conducted a study of 3000 subjects receiving general anesthesia for caesarean section and gave an incidence of 0.9% recall of perioperative events. Bogetz and Katz (1984) interviewed 51 patients with major trauma and found recall

to be a much higher 11%, and suggested that anesthetic technique should be factored into variables effecting intraoperative recall.

The legal and ethical duty of anesthesia personnel is to ensure the safest anesthetic possible, which includes taking every precaution available to bring about a reduction in the threat of recall in the surgical patient population. Many researchers have focused efforts on the development of tests and studies to measure and analyze recall, as well as ways to utilize recall to the benefit of the patient. Grunshaw (1990), reported concern that patients who were paralyzed with neuromuscular blockade allowed no true way to measure for inadequate levels of anesthesia, and may be totally aware of operative events. Such reports heighten concern for all anesthesia personnel to assure that adequate amnestic levels of anesthesia are obtained. Two studies that focused on ways to utilize recall were by Block, Ghoneim, Sum Ping, and Ali (1991a), and Boek, Bonke, BouWhuis-Hoogerwerf, Bovill, and Zwaveling (1988), who presented therapeutic suggestions to patients in the perioperative period in hopes of improving postoperative recovery.

Throughout associated literature many terms have been used to refer to the phenomena of recall and awareness occurring under general anesthesia (GA). The use of multiple terms for recall has often led to confusion regarding what

is being examined in studies. The concepts of recall and memory have integrated many aspects of the patient's ability to recover events from memory.

In order to distinctly classify and study the different aspects of memory, it has been divided into two categories; implicit and explicit (Andrade, & Baddeley, 1993). One method of determining what level of awareness or recall the patient has experienced is the use of implicit and explict memory, also known as indirect or direct memory respectively. Dosch (1988) linked awareness with dreaming. Recall was described as the ability of the patient to remember any event occurring while presumed unconscious and dreams were described as thoughts or images believed to occur during the intraoperative period. Hobbs, Bush, and Downham (1988) investigated dreaming and awareness in children and made distinctions in the occurrence of each.

As the incidence of recall is confirmed in literature, anesthetists must continue to investigate ways to make the operative experience more humane. Physical aspects of analgesia, autonomic control, and muscle relaxation, should not be the only areas of research. Methods of assuring amnesia, and discovery of ways to use recall for the patients benefit should also be explored. Intraoperative recall can be an ominous threat to the patients perception of medical care. If recall is experienced, the patient may develop an unreasonable fear of all aspects of health care

and possibly jeopardize future compliance with the health care team, causing a tumultuous recovery in a period when when psychological as well as physical well being is of utmost importance. The purpose of this study is to examine the incidence and content of intraoperative recall in the unpremedicated patient undergoing surgery with GA, who has received a pleasant preoperative suggestion before induction, as compared to those patients who do not receive a preoperative suggestion. Anesthetic technique will include induction with propofol and maintenance on N2O and isoflurane (Forane).

Research Hypothesis

Incidence of intraoperative recall will be significantly higher in those patients receiving a pleasant preoperative suggestion, as compared to those receiving no suggestion.

Relevance to the Practice of Nursing Anesthesia

Nurse anesthetists endeavor to provide an optimal pre-, intra-, and postoperative experience for the patient population served. This endeavor includes carefully balanced anesthesia to ensure no remembrance of intraoperative events. Since anesthetic needs vary individually, recall can be a potentially harmful factor, inadvertently causing a fearful dread of further medical care and potentially

increasing medical requirements, as well as lengthening recovery period. In the event recall does occur, nurse anesthetists may provide a therapeutic aspect to this phenomena by prompting a pleasant thought, which the patient might invoke during the operation. This type of recall can foster a sense of well being, decrease post-anesthesia care unit (PACU) time and analgesic requirements, as well as shorten hospital stay. Each of the listed positive outcomes directly impacts the practice of nursing as a whole and can significantly influence patient outcome and the healthcare system.

Definitions

1. Recall - the awareness of specific events by explicit or deliberate attempts to bring past events to the foremost thought, or by indirect means through exhibiting behaviors which may have been subconsciously recorded in the memory. Recall may include events that are real or perceived as real by the person (Dorsh 1988).
2. Preoperative - the period of time leading up to a patients' surgery.
3. Intraoperative - the period of time in which a patient has received medication to bring about a loss of consciousness, amnesia, autonomic control, and muscle relaxation in which surgery can be

performed without patient distress.

4. Postoperative - the period of time in which the patient has left the operating room and is recovering from the effects of anesthesia and surgery.

5. General anesthesia (GA) - One of several classifications of anesthetic techniques which allow for analgesia, amnesia, autonomic control and muscle relaxation. This is accomplished through the use of inhaled anesthetics; N2O, isoflurane, halothane, enflurane, desflurane, or administration of a mixture of hypnotic medications intravenously (IV) to maintain plasma levels of adequate amount to produce the desired effect (Stoelting, 1989, p. 115)

6. Induction of general anesthesia - administration of IV or inhaled medications to produce a rapid loss of consciousness. Loss of consciousness is usually followed by administration of muscle relaxants (i.e., succinylcholine, vecuronium) to facilitate placement of an endotracheal tube by laryngoscopy.

Assumptions

1. Patients in the intraoperative period of anesthesia continue to process information at varying anesthetic depths.

2. Patients interviewed will respond with accurate and truthful information.

Limitations

Limitations of the study are identified as follows:

1. Predisposition to dreaming may not be the same for all subjects studied.
2. No documented studies have indicated appropriate time for conducting postoperative interviews.
3. Propofol has been implicated in causing dreams.

CHAPTER 2

Review of Literature

Theoretical Framework

Atkinson and Shiffrin's Modal Model of Memory, (Figure 1) as described by Andrade and Baddely (1993), shows input from the environment being processed into the short term memory (STM) where information is assessed, used and manipulated. Information in the STM is met with response or forgotten. As new information comes in, information in the STM is transferred into the long term memory (LTM), where increased amounts of information can be stored for longer periods of time.

Guyton (1991) describes the physiology of memory as being brought about by changes in synaptic transmission from one neuron to the next. Stoelting (1991) describes the attainment in of STM and LTM by two methods. STM may be the result of stimulation at the synaptic site. After a period of excitability, the synapses change and resting transmembrane potentials decrease. LTM may result from repeated stimulation of presynaptic vessels with permanent increases in conduction and size of the dendrites.

The role of the anesthetist is to produce amnesia

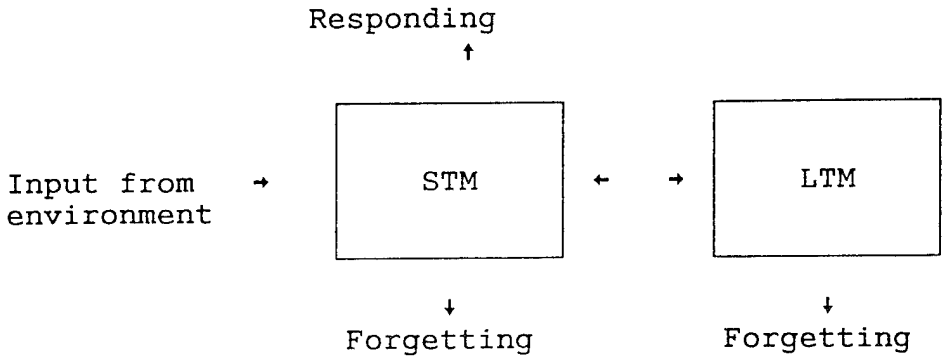

Figure 1.

Modal Model of Memory

Atkinson, R.C., Shiffrin, R.M., Human memory: a proposed system and its control processes. (as cited in Andrade, J., & Baddeley, A. (1993)

through blockade of sensory information into the STM. It is known that this can be accomplished to some measure by pharmacological means. In the event information is processed, it is hypothesized that a psychological method may be able to call upon a preoperative suggestion to replace information that may be acquired during the intraoperative period.

Literature Review

The published study of anesthesia is described in 1842 with Crawford Long's use of vaporized ether to produce surgical anesthesia. In 1844, Horace Wells used N2O in a demonstration at Massachusetts General Hospital and failed to produce surgical anesthesia (Stoelting & Miller, 1989). Descriptions of the first anesthetics administered give account of failed amnesia and patient awareness. Visible signals of adequate anesthetic depth have been clouded with the use of neuromuscular blockers (Rogers, Tinker, Covine, & Longnecker, 1993). Obviously ,the use of muscle relaxants to prevent movement and provide surgical relaxation do not provide amnesia or analgesia needed during a surgical procedure. The incidence of recall has began to diminish with the development of new anesthetic agents.

As data supporting the incidence of awareness continues to surface (Sebel, 1994), anesthesia personnel endeavor to

explore pharmacological and psychological methods as a means of eliminating recall or better yet, using recall to the advantage of the patient. This literature review focuses on three areas of research associated with recall. The areas are: (a) measurement of memory under general anesthesia, (b) influence of anesthetic technique on recall, and (c) therapeutic suggestion in general anesthesia.

Measurement of Memory

Memory as described by Andrade and Baddeley (1993) can be looked upon as a mirror of our experiences, thoughts and perceptions. Memory is relied upon for participation in nearly all aspects of our lives and is divided into sub-units of STM and LTM. STM requires the temporary processing of information. LTM is utilized when large amounts of information is stored for a longer period of time. Dividing memory into sub-units has enabled researchers to better organize and focus on a array of often complex memory structures. Methods of memory measurement are further sub-grouped into direct or explicit memory and indirect or implicit memory. Ghoneim and Block (1992) define implicit memory as that memory measured by completion, identification, and skill learning, tested after exposure to target materials. Memory of this nature requires no conscious effort for retrieval of information. Direct or explicit memory is that which is consciously sought.

Information is acquired into memory by the five senses. During general anesthesia, auditory and tactile stimulus have been observed as a means of experiencing recall of intraoperative events. Auditory evoked potentials in the brain, measured by an electroencephalograph (EEG), remain intact at deep levels of anesthesia, confirming the potential for acquisition of data while anesthetized. Auditory perception is determined as the most important sensory avenue for processing information under general anesthesia.

Schwender, Klasing, Madler, Poppel, and Peter (1993) in a descriptive study, evaluated auditory evoked potentials in 45 patients receiving general anesthesia (GA). Potentials were recorded awake and during GA, both before and after an audio tape presentation. It was found that during anesthesia auditory events can be processed and recalled postoperatively when primary cortical stimuli processing is preserved. Griffith and Jones (1990), suggest as anesthetic depth increases the brain continues to be aware of events in the outside world. The events experienced are recorded in the LTM, though recall into consciousness becomes progressively impaired, hence recall without awareness. Tests of memory measurement have been instituted for explicit and indirect memory as a means of quantifying recall with the realization that information can be processed in the anesthetized patient.

Explicit memory. Ghoneim and Block (1993) reported the incidence of awareness during anesthesia of the general population as less than one percent. Patients are usually questioned regarding experiences in the intraoperative period to measure explicit memory. Liu, Thorp, Graham, and Aitkenhead, (1991) conducted a descriptive study with postoperative interviews on 1000 patients receiving GA. Exclusion criteria were identified as: (a) under 16 years of age, (b) obstetrical or intracranial surgeries, (c) mental confusion, (d) lack of command of the english language, (e) or discharge before interviewed. The interviews were conducted 20-36 hours after surgeries by a standard set of questions for determining memory in the intraoperative period. Sixty three percent of the patients were unpremedicated with opiods or benzodiazepines. Two patients were found to have recall after induction, but before incision, with 95% confidence intervals of 0.02 - 0.7%. Awareness was attributed to small induction doses of anesthetic drugs. An identified weakness in this study is relating awareness to subanesthetic induction doses for the purposes of measuring recall. Recall would be expected if someone was not adequately anesthetized. Ghoneim and Block (1993) found failure of equipment, misuses of equipment, or inadequate anesthesia as common causes of explicit recall supporting findings of their earlier study.

Tunstall (1977) reported a technique for measuring

wakefulness called the "The Isolated Forearm Technique", (IFT) which would require the patients use of explicit memory. This test allowed diagnosis of intraoperative wakefulness. The procedure involved application of a blood pressure cuff after induction of anesthesia and before administration of a neuromuscular blocker (NMB). After the cuff was inflated NMB was administered. In this dramatic approach patients were instructed per tape recording to move their fingers. Thirty three percent of the patients moved their hand in response to instruction, yet all of the subjects denied recall or dreaming when interviewed in the postoperative period. In 1987, Wilson explored a similar technique. No statistical data were described, though the limitation of reflex movement was mentioned and also should be assessed in similar studies.

Stolzy, Couture, and Edmonds (1985) performed a study to detect purposeful movement in the anesthetized patient. A convenience sample (n=25), American Society of Anesthesiologists (ASA) class I-III (Appendix A) patients who had received standardized anesthetics were asked to respond to a verbal command intraoperatively. All patients were maintained on an N2O and narcotic based anesthetic. A postoperative interview was conducted as a method for determining recall of intraoperative events. Spontaneous movement was observed in 76% of patients. A positive response to command occurred in 36% with only 4% claiming

postoperative recall. A possible limitation is discussed on the part of the observer in maintaining consistency of observation of movement. The low incidence (4%) of recall made the frequency of spontaneous movement a poor indicator of intraoperative recall.

Bogod, Orton, Yau, and Oh, (1990) conducted a non-blinded descriptive study to detect awareness during caesarean section. A convenience sample of 74 patients receiving GA for caesarean section using the IFT as described in Tunstall's (1977) study. Esophageal contractility, which is a measure of depth of anesthesia was also evaluated. The IFT was reported as an ineffective measurement method in this study. Lower esophageal contractility was found to be the most effective of the parameters indicating subanesthetic levels. It should be noted that caesarean section has been reported to be one of the surgical techniques in which recall is a significant possibility due to the inability of anesthetics to be administered at adequate doses before the delivery of the fetus.

Implicit memory. Intraoperative testing of implicit memory was pioneered in an experimental study in 1985 by Bennett, Davis and Giannini. A double blind study was conducted of patients having herniorrhaphy, cholecystectomy, and orthopedic surgeries. A standardized GA was administered. When adequate anesthetic depth was achieved an

intraoperative suggestion was given for patients to touch their ear during a postoperative interview. The patients were also tested for their ability to be hypnotized, after which they were regressed to the time of surgery. After regression, patients were questioned regarding remembrance of intraoperative events. The study consisted of 33 ASA class I and II patients. Thiopentone was used for induction, anesthesia was maintained with N2O, enflurane or halothane, as well as NMB. A control group, heard a blank tape and showed no explicit recall from the intraoperative period. Results of indirect memory were collected through observation in the postoperative interview for the number of times the patient touched their ear. Nine of 11 (n=11) patients in the suggestion group touched their ear, along with nine of the 21 (n=21) patients in the control group. Statistical analysis indicated significant difference in the control versus the suggestion group. Bonke and Rupreht (1986) challenged the validity of this study by pointing out that the taped messages were played at five minute intervals close to the reversal of the anesthetic, suggesting the patient might not have been at the deepest of anesthetic levels during the last tape presentation.

Block et al., (1991b) looked for implicit memory in 72 women undergoing surgery to determine if learning occurred during anesthesia. A blinded and randomized, experimental study was conducted using an anesthetic regimen which

consisted of N2O and opiod (n=24) or N2O with varying degrees of isoflurane at 1%, 1.3%, and 1.5% minimal alveolar concentration (MAC), administered to a sample size of 12, 24, and 12, respectively. Three categories of test were administered; behavioral, constrained word association, and nonsense word identification tests. The behavioral test consisted of suggestions for patients to touch their ear or nose. A constrained word association test gave a category such as fruit, and then words, such as apple or banana, that could be assigned to these categories. Statistical analysis of variance revealed patients touched the suggested body part longer than nonsuggested ($p < 0.05$). This implicit memory test indicated learning under GA. A limitation of this study can be identified in that those patients having longer operations heard the tape more often.

Bethune et al., (1992) evaluated surgeries of greater intensity by an experimental study of 48 patients undergoing coronary artery bypass surgery for learning during GA. Patients were randomly assigned to receive an infusion of propofol or methihexital, supplementing a fentanyl based anesthesic. A tape was played with emphasis on certain words. After each key word was presented the patient was instructed to touch their ear. Patients were randomized into two groups. In the first group, 12 received propofol, 12 methihexital, and heard the taped message intraoperatively. The second group (n=24) heard the message after surgery

completion in the Coronary Care Unit (CCU). The patients receiving the suggestion to touch their ear during surgery had significantly higher recall of word associations than the patients receiving the behavioral suggestion in the CCU. The CCU patients did not exhibit implicit recall. This study links the depth of anesthesia with the amount of stimulus the surgery creates, fostering the idea that recall can be associated with increased intensity of surgical stimulus. A strength of this study is found in the preoperative interview, conducted to determine possible chance identification of word associations in 25 subjects not exposed to the taped message.

Anesthetic technique

The relationship of anesthetics and the incidence of associated recall have been evaluated. Studies on midazolam, combinations of midazolam and propofol, as well as inhalation/opiod techniques and the effects of each on memory will be reveiwed.

Midazolam. Amnestic agents classed as benzodiazepines; (midazolam, diazepam, lorazipam), have been given during the preoperative period in an effort to prevent recall. Benzodiazepines act on specific neuro-receptors to produce anti-anxiety effects and suppress recall of events occurring after administration of the drug. Ghoneim and Block, (1992) report benzodiazepines to have profound effects on memory as

well as being useful as an anxiolytic, preanesthetic, and induction agent. Benzodiazepines exert their effect by stimulation of gamma amino butyric acid, (GABA) which is an inhibitory neurotransmitter, (NTM) in the brain. Benzodiazepines also enhance the ability of GABA to bind to special neural receptors. GABA interacts with specific receptors which control chloride ion movement; therefore, inhibiting neural conduction of impulses. GABA, benzodiazapine and choloride receptors are located in areas thought to be high in formation of memory (Ghoneim & Block 1992).

Dixon, Power, Grundy, Lumley, and Morgan (1984) compared sedative and anesthetic effects in an experimental study on IV midazolam and diazepam in 100 patients receiving sedation and local anesthesia. Patients were randomly assigned to receive diazepam 0.15mg/kg or midazolam 0.08mg/kg. Sedation was assessed during the administration of the local anesthetic, perioperative period, and recovery period with a scale of four categories, ranging from not drowsy, to asleep and unresponsive. On the first postoperative day a questionnaire was given to assess memory of intraoperative events. Fifty percent of the patients receiving midazolam had no intraoperative memory compared to 20% receiving diazepam ($p < 0.001$). Midazolam was found to be a better amnestic. Questioning the patient the first postoperative day could raise the question of

appropriateness of setting a time restriction on when the interview should be done.

Persson, Nilsson, and Hartvig, (1988) evaluated a convenience sample of 20 women scheduled for abdominal surgeries. The relationship of sedation and amnesia to plasma levels of midazolam were investigated. Group one (n=10) received midazolam and epidural anesthesia. Group two (n=10) received total intravenous anesthesia (TIVA) with midazolam and alfenta. Effects were assessed by a rating scale divided into degrees of amnesia. The study identified blood levels of > 250 to 300 ng/ml of midazolam as the threshold for maintenance of hypnotic effects. Midazolam plasma levels were found to be a major determinant of amnesia. Concomitant use of narcotics were reported to be synergistic with midazolam and prolong sedation. A limitation of this study was that the patients were premedicated with a narcotics. All surgical patients are not premedicated with narcotics in the preoperative period. The study also lacked randomization.

Midazolam and Propofol. Short and Chui (1991) measured dose response curves for midazolam and propofol alone and in combination to determine synergism. A convenience sample of 200 women for gynecological surgeries was studied. Ages ranged from 18-40. One hundred twenty patients were randomly assigned into 12 groups of 10. One of seven doses of IV propofol was given ranging from 0.7mg-2.5mg/kg, or one of

five doses of midazolam from 0.1mg-0.2mg/kg were administered intravenously. Persons administering the medications were blinded to the dosages given. In the second part of the study midazolam and propofol was given in combination in a range of 0.03-0.2 mg/kg to 0.17 to 1.2mg/kg respectively. Allowances were made for peak effect by administering the midazolam two minutes prior to the propofol. Statistical analysis of variance was done to compare age, weight, and arterial blood pressures in the groups. No significant differences were found. When a combination of propofol and midazolam were used, 85% of the patients went to sleep using smaller doses of each drug together, as compared to using the agents individually. The study concluded that a combination of propofol and midazolam together produced more effective amnesia than either drug alone. A weakness of this study was in measurement of blood pressure for only a short interval after induction, giving the impression that the dosages of drugs cause less hypotension than they possibly did.

White and Negus, (1991) executed a comparison study of midazolam and propofol to evaluate the effects of each in their use with regional anesthesia. The design of this study consisted of an "...open label, randomized study with blinded observers assessing recovery data" (p. 32). The sample size consisted of 68 ASA I-III patients undergoing elective surgery. Patients were given either midazolam 0.9-

3.1 mcg/kg/minute, after a loading dose of 3.8-5.6mg or propofol 45-78 mcg/kg/minute after 69±23mg loading dose. Level of conscious was monitored with a five point scale ranging from awake and alert to unresponsive with tactile or verbal stimuli. Midazolam was found to be more effective as an intraoperative amnestic. Propofol was found to produce less postoperative sedation. Patients receiving propofol returned to 89% of baseline sedation scores within 60 minutes compared to 43% with midazolam ($p < 0.05$). An interesting aspect of this study was that even though postoperative interviewers were blinded to the drug used, they were able to identify the patient receiving propofol and midazolam 96% and 92% of the time by assessing sedation levels. An important aspect of this test was the administration of a pretest to ensure baseline values for comparison.

Inhalation Anesthetics. Intravenous agents are not singled out as the only possible method for prevention of intraoperative awareness. Eger et al, (1990) evaluated the roll of nitrous oxide in preventing intraoperative recall. An experimental study was performed on 270 patients that were scheduled for hip arthroplasty (n=100), carotid endarterectomy (n=70), orhypophysectomy (n=100). Investigators who performed the patient interviews, or participated in data collection and analysis were blinded to methods. Patients were randomly assigned to receive

isoflurane with or without 60% N20. Patients not receiving N20 had higher levels of recall for intraoperative events. The group receiving N20 reported less dreaming and remembrance. An interesting feature in this study was the inclusion of patients having intracranial surgery. This is an obvious limitation due to the potential for effects on memory centers. Another consideration is the varying levels of isoflurane used with N2O which effects MAC levels. A limitation was the types of surgeries studied. Several surgeries were known to produce symptoms being observed in the recovery period.

Newton et al.,(1990) solicited 80 healthy male volunteer subjects for an experimental study on levels of consciousness of those breathing sub-MAC levels of isoflurane, varying from 0.1 - 0.4% MAC (MAC = 1.15% isoflurane). Results demonstrated that even the least concentration of isoflurane caused some impairment of recall. Treatment groups showed significant differences between levels administered and conscious memory of word lists presented during anesthesia. A point to be made is that this test occurred with out surgical stimulation which could alter the results.

Dwyer, Bennett, Eger, and Heilbron (1992) as did Newton et al., (1990) looked at awareness in volunteers receiving a subanesthetic doses of isoflurane and N2O. Subjects consisted of healthy male adult volunteers who were randomly

assigned to receive isoflurane or N20. Methodology included a pretest interview, an important aspect many investigations have not incorporated. This can be utilized as a method for identifying the possibility of chance response by the population being tested. Subjects received isoflurane 0.15 - 0.5% MAC, and N20 0.3 - 0.6% MAC (MAC being 110%). The test instructed the patient to make a purposeful response to verbal command intraoperatively and to recall answers to general knowledge questions presented preoperatively as well as a behavior suggestion. Postoperative tests were administered to measure both indirect and direct memory. Results revealed isoflurane to be more potent than N2O in MAC equivalent concentration to prevent memory. ED95 concentration for preventing memory in 95% of volunteers was isoflurane, 0.43% MAC with 95% confidence intervals of 0.36-0.55, and 0.73% MAC for N2O with confidence of 0.65-0.87.

Dwyer, Bennett, Eger, and Peterson (1992), in an experimental study, looked at levels of isoflurane that would prevent conscious learning. A convenience sample of 45 patients, aged 23-58 and undergoing elective surgery were presented 15 general knowledge questions preoperatively and told the answers would be given during the course of their operation by taped recording. Patients were also instructed to touch their ear in the postoperative interview.

No preoperative medications were administered. Anesthesia was induced with inhalation of isoflurane and N2O

with oxygen (O2). Inhaled anesthetics were supplemented with propofol 1.1 ± 0.06 mg/kg and vecuronium 0.07 mg/kg. N2O was eliminated after induction and anesthesia was maintained on Isoflurane at end tidal concentrations of 0.6% MAC. Taped messages were played in which the answers to five questions were presented at three levels of anesthesia as measured by end tidal concentrations between 1.0%-1.4%.

Observers in the postoperative interview were blinded to the questions and suggestions presented intraoperatively. There was no significant difference in touching of the ear in the postoperative period. The number of questions answered postoperatively did not significantly differ from the preoperative test. A meaningful aspect of this test was the administration of a pretest to a control group to determine the ease of learning the material presented.

The number of correct answers was compared for each dose of isoflurane administered and the control group. Control subjects recalled nearly all answers to questions, while those presented intraoperative answers did not differ from those with varying anesthetic concentrations. The conclusion of this study was that end tidal concentrations of ≥ 0.6% MAC prevent memory during anesthesia or retrieval of information processed. The investigators were confident of their attempts to ensure reliability of measurement by having two observers count ear touching. A limitation of the study was the lack of surgical stimulation at the time

information was presented, which could increase anesthetic requirements for impairing memory.

Therapeutic suggestion

Therapeutic suggestion during the intraoperative period could possibly improve the recovery period of patients receiving GA. Block et al, (1991a) did an experimental study using double blind conditions, in which 209 patients were randomizly assigned to one of two groups. One group received a taped suggestion of a smooth postoperative recovery, and a control group was played a blank tape.

Anesthetics used for the study consisted of one of two techniques. Anesthesia was induced in both groups with isoflurane. After induction, one group received with 70% N2O and 1 -1.5% isoflurane. Bolus doses of fentanyl were administered to maintain systolic blood pressure within 15% of preanesthetic levels. The second group received an N2O and opiod anesthetic, fentanyl 7.5 mcg/kg or equivalent boluses of other opiods as adjuncts. Therapeutic suggestions were presented until end tidal concentrations were at or below determined levels.

Statistical analysis revealed no significant difference between controls and those receiving the suggestions. A limitation of this study was found in the type of surgery some of the patients had. Those admitted for banded gastroplasties were already motivated to do well in the

postoperative period by their desire to loose weight.

Evans and Richardson (1988) conducted an experimental double blind randomized study to determine if recovery and postoperative stay could be reduced after therapeutic suggestions were given intraoperatively. Thirty-nine patients were divided into two groups receiving therapeutic suggestion or a blank tape. Anesthetic technique consisted of intravenous and inhalation anesthetics. The mean postoperative stay for the group receiving therapeutic suggestion was 1.3 days (16%) less than the control group ($p< 0.002$). Researchers identified measures taken to ensure reliability of results. A limitation identified was observers bias toward what severity of symptoms the patient exhibited in the PACU.

McLintoc, Aitken, Kenney, and Downie (1990) performed an experimental prospective double blinded randomized study of 63 women for elective abdominal surgery. The purpose of the study was to see if an intraoperative suggestion would reduce postoperative medicine requirements. Patients were presented a tape with either a postoperative suggestion or a blank tape. Anesthesia was maintained with N2O/O2 and enflurane with end tidal concentrations of 0.8-1.5% after induction of anesthesia with thiopentone. The suggestion stated that surgery was going well and pain would not be of postoperative concern. Results showed women receiving perioperative suggestions received 23% less morphine than

those who were played the blank tape (p= 0.028). No patients reported recall or dreaming in the operative period. An interesting point of this study was that patients were allowed to self medicate using controlled analgesia pumps. This is a limitation in the study due to the possible inability of the patient to use the equipment at the time they are in pain.

Summary

Research has suggested the acquisition of information while under anesthesia. The extent to which information is processed is unpredictable due to the varying degrees of anesthetics required in individuals. New benzodiazepines have reduced fears of recall. In neuromuscular blocked patient, who cannot move in response to inadequate levels of anesthesia, recall may still pose an enormous threat.

Researchers should attempt to open every avenue possible to create positive effects from a potentially traumatic experience as long as anesthesia personnel are reporting intraoperative recall. In this study the researcher will attempt to utilize the patients' ability to Process information during the intraoperative period. assumption will be made that the patient will be able to selectively use information, whether it is actual events during their operation, or an imaginary or hallucinatory event selected to focus on in the intraoperative period.

CHAPTER 3

Methodology

An experimental study will be conducted to determine if recall of a pleasant thought or memory can be prompted by a preoperative suggestion in a patient receiving GA. This chapter includes design, setting, selection of sample, and instrumentation. The procedure layout, data analysis plan, and ethical considerations are also given.

Research design

An experimental study design will be used to examine if the incidence of intraoperative recall is greater in patients receiving a preoperative suggestion compared with those who do not. Measurement will be assessed through a structured postoperative interview, conducted 12-24 hours postoperatively.

Sample

A convenience sampling will be used for this study. Patients presenting to the University of Tennessee medical Center will be randomly assigned to a control or experimental group. Patients will not be aware of the group to which they are assigned. As shown in the review of

literature, recall with intraoperative suggestion has been the subject of many studies; however, research using preoperative suggestion as a prompt for intraoperative recall has not been studied. Due to the lack of studies effect size for the population has been chosen to be 0.20. Significance for this study will be set at 0.05, and power of 0.80. Due to the small effect size a sample of 784 subjects would be needed to show statistical significance. Due to time factors this study will use 30 subjects, with limitations of this sample size recognized.

Controls for enrollment or exclusion will be as follows:

Enrollment

1. ASA classification I or II.
2. Age 20 to 65 years old.
3. Requiring general anesthesia.
4. All types of general surgery will be included in the study.

Exclusion

1. Use of benzodiazepines preoperatively.
2. Use of psychotropic drugs.
3. Current history of drug or alcohol abuse.
4. Known mental disorders.
5. Organic brain diseases.

Omission criteria

1. Intracranial procedures.
2. Procedures under 30 minutes.

Setting

The setting for this study is a 600 bed University Hospital. The hospital is located in Knoxville Tennessee, and carries a level III Trauma designation.

Instrumentation

Instrumentation for this study will be through administering a scripted pleasant preoperative prompt for the subject to recall during the general anesthesia period (Appendix B). Literature has been presented in support of learning under general anesthesia. Ghoneim and Block (1991) presented conflicting results of presenting therapeutic suggestions intraoperatively. Documentation has not been found for the use of preoperative suggestions or possible intraoperative effects, though theoretical works have been published on similar metaphysical processes like imagery, operative conditioning and systematic desensitization (Perko & Kreigh, 1988 p.85).

A postoperative interview (Appendix C) will be used to gather information from subjects. The reliability and validity have not been established for the instrument to be used in this study. The concept being measured is

intraoperative recall of a preoperative suggestion. This can be measured by use of explicit memory through answering questions related to the concept. The researcher will ask questions from a scripted outline to insure consistency between interviews. Questioning will include those inquiring about dream content. Patient satisfaction questions will also be included in an attempt to prevent the patient from biasing his views about the purpose of the interview. Demographic information will be obtained from the medical record and recorded on a prepared form (Appendix C).

Procedure

As an experimental study, subjects meeting set criteria will be divided by a computerized random number generator into either a suggestion or experimental group. Fifteen patients in the control group will receive a standard anesthetic as outlined in the protocol (Appendix D). No preoperative suggestion will be given to the control group. A postoperative interview will be conducted within 12-24 hours. The person conducting the interview will be blinded as to which group they are interviewing.

Fifteen patients will also be assigned to an experimental group where they will receive the preoperative suggestion prior to the administration of the anesthetic outlined in the protocol. The interview will be conducted the same for each group.

Induction period. Preoxygenation with six liters of oxygen will be accomplished for two minutes on all subjects. Subjects will receive intravenous (IV) dosages of lidocaine 1.5 mg/kg, fentanyl 2.5 mcg/kg, and propofol 2.5 mg/kg followed by one of two drug regimens for intubation. To facilitate intubation, either a nondepolarizing muscle relaxant (NDMR) or succinylcholine 1.5mg/kg will be used. In the event succinylcholine is used for intubation, preoxygenation will be preceeded by administration of d-tubocurarine 0.06mg/kg. Vecuronium will be the NDMR used as the alternative intubation method with a dose of 0.1 mg/kg IV. The experimental group will receive the preoperative suggestion prior to the administration of fentanyl.

Maintenance of Anesthesia. Maintenance of anesthesia will be accomplished to maintain autonomic control of blood pressure and heart rate at ± 20% of baseline levels through use of N20/O2 mixture at 3 and 1.5 Liters respectively, and vaporized isoflurane. In the event NMB is required, vecuronium 0.05 mg/kg will be administered as an initial dose, followed by 0.01 mg/kg as needed for maintenance of NMB at 90%. Fentanyl 50 mcg doses will be given as a supplement for those requiring more analgesia.

Discontinuation of Anesthesia. If NMB is used, reversal will be accomplished with IV glycopyrolate 70 mcg/kg, followed by neostigmine 0.05 mg/kg. At the onset of skin

closure isoflurane will be discontinued, followed by N2O at completion of closure. At completion of wound closure oxygen will be increased to eight liters per minute. Anesthesia technique will remain constant in regards to drugs used. Variation could take place in the amount of time required for skin closure, owing to surgeon technique and experience, making isoflurane discontinuation variable.

Data will be gathered by an interview 12 to 24 hours postoperatively using a structured data collection sheet (Appendix C).

Analysis of data

Statistical analysis will be through use of Fisher exact test due to the small sample size. Unpaired t-tests will be used to measure group differences of intraoperative recall in subjects receiving the preoperative suggestion and those who do not.

Human subject considerations

Permission was received from the University of Tennessee Medical Center Institutional Review Board (IRB) to conduct this research study (Appendix E). No unusual treatment was given to any patient participating in the study. A routinely administered anesthetic protocol was used on all subjects. Premedication was not withheld from those in need of preoperative medication. In the event a patient

to be enrolled in the study needed preoperative medication, it was given and they were withdrawn from the study. It was requested that informed consent be waived. Informed consent would have inadvertantly given the control group the preoperative suggestion and bias the study. The IRB waived the patient consent requirement. Patient confidentiality was maintained. Data related to enrollment, administration and outcome was secured during all portions of the study.

No aspect of drug administration or patient care was randomized. All patients received a standard, non-experimental anesthetic technique. The only randomization involved the use of a simple two sentence suggestion prior to administration of a general anesthetic.

CHAPTER 4

Results

The results of the study are presented in this chapter. Results include demographics of the sample and a description of the data collected.

Demographics

The original sample number was decreased from 30 subjects to 14, due to time constraints. Table 1 presents the demographic make-up of the 14 subjects used in the study. Nine were females and 5 males. The mean age was 38.21, with an age span of 21-58 years. The standard deviation was 13.25 years. Means were tested with *t*-tests and no differences were found.

Surgical procedures performed on the subjects included: gynecological (GYN), genitourinary (GU), ear, nose and throat (ENT), orthopedic (Ortho), and abdominal (Abd). Gynecological procedures comprised the largest number of procedures performed at 35.7%. Table 2 shows further breakdown of the surgical categories. Participants were classified as ASA status I or II, with four (28.5%) in class I and ten (71.5%) as class II.

Table 1

Sample Demographics (n = 14)

	Mean	SD
Mean age (years):		
Population	38.21	13.25
Control subjects	40.14	12.50
Experimental subjects	36.28	13.99
Duration (minutes)*		
Population	63.57	25.74
Control subjects	61.42	37.83
Experimental subjects	65.71	13.67

Note* Duration of anesthesia in minutes from induction to first vital sign in recovery room.

Table 2

Surgical categories

Type	**Population**	**Control %**	**Experimental %**
GYN	35.7%	28.6%	42.8%
ENT	28.5%	28.6%	28.6%
GU	21.4%	42.8%	0%
Orthopedic	7.2%	0%	14.3%
Abdominal	7.2%	0%	14.3%

Anesthesia time ranged between 37.5 and 112.5 minutes, with a standard deviation of 25.75. Mean anesthesia time was 63.57 minutes. Table 1. gives group specific representation.

Analysis of Data

The hypothesis tested the incidence of intraoperative recall and compared recall in patients receiving a pleasant preoperative suggestion to patients who received no suggestion. The results were measured through adminstration of a questionnaire. All subjects were interviewed and asked five questions regarding their surgical and anesthetic experience. Two of the questions were related to recall and five were confounders to prevent the subject from being biased to the intent of the questionnaire.

The results of the study revealed that no subject reported recall of the intraoperative period or dreaming. Therefore, the research hypothesis was rejected. No coorelational differences were found between the experimental and control groups.

CHAPTER 5

Conclusions and Discussion

Conclusions, discussion, limitations and implications for future research are presented in this chapter. This study compared the incidence of intraoperative recall in patients receiving a pleasant preoperative suggestion to those not receiving a suggestion. All subjects received a standardized anesthetic technique. The study failed to show recall by either group.

Literature reviewed and cited studies continue to show adequate amnesia in an overwhelming majority of surgical procedures under a variety of anesthetic techniques. It is documented that rare instances of recall do occur. Since the intent of the study was to introduce a pleasant thought process during the anesthetic period and have the thought recalled in the postoperative period, alternative methods of measuring indirect recall would not further the purpose of this study.

Limitations

An identified limitation to the study was the reluctance of anesthesia personnel to eliminate use of benzodiazepines

from their anesthetic regimen for fear of recall by the patient. Benzodiazepines have been proven to cause amnesia, a desirable combination of a GA (Stoelting 1991). This may have been controlled if the researcher had informed anesthesia personnel of recent literature regarding recall in the intraoperative period.

A second limitation of the study was the number of anesthesia personnel involved in the study. Even with a scripted preoperative suggestion and designated time for recital, different personalities, voice inflection, and tone could create variability in the patients perception of the suggestion.

Another limiting factor could be noise pollution caused by pulse oximeters, electrocardiograph, and blood pressure machinery during the preinduction period. Background noises in the operating room are often very unfamiliar, loud and frightening to the patients. The noise level could distract the patient from being attentive to instructions being given by the anesthesia providor.

A limitation not accounted for was the medications given in the recovery room prior to the postoperative interview. Typically patients are medicated in the recovery room recovery room with antiemetics like droperidol and promethazine which interfere with certain receptors known to affect the memory. Methods for reviewing recovery room records and controls for these medications should have been

implemented prior to conducting the study.

Recommendations for Future Research

This study was conducted with the intent of providing a less stressful hospital experience for the patient having surgery. Further research should continue for methods of promoting patient satisfaction and reducing stress. In searching for these methods, mention should be made of one patient who was excluded from the study due to an anesthetic technique different from the criteria. This patient was provided anesthesia with a propofol infusion based anesthetic. This patient did report having recall of vacationing during the surgical experience. This technique could be used as a variation of the study and possibly promote a pleasant thought process intraoperatively and immediately postop. Further suggestions include comparison of satisfaction in patients receiving preoperative medications compared to patients provided personal attention and comforting words from anesthesia personnel.

Summary

This study did not show recall of a pleasant preoperative suggestion by any subjects. The method of presenting a pleasant preoperative suggestion did not prove effective in creating a better hospital experience. However, the assumption cannot be made that positive verbalization by

anesthesia personnel and imagery used by the patient can not lead to increased satisfaction. Dosch (1988), reported that the incidence of awareness among anesthetized patients ranges from as little as one percent to as much as 40%. Anesthesia personnel should continue to examine and create ways to provide the least stressful preoperative, induction period, emergence and postoperative outcome for the patient. As consumers of health care, patients are entitled no less than this.

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Appendices

Appendix A

Physical Classification Status of
the American Society of Anesthesiologists
(ASA)

Class 1. The healthy patient.

Class 2. The patient with a mild systemic disease that mayor may not be related to the reason for surgery.

Class 3. A patient with severe systemic disease that is not incapacitated.

Class 4. A patient with a severe systemic disease that is a constant threat to life with or without surgery.

Class 5. A moribund patient not expect to survive with or without an operation.

E. Added in the event that any of the above are done on an emergency basis.

Adapted from information in American Society of Anesthesiologists. (1963). New classifications of physical status. *Anesthesiology, 24,* 111.

Appendix B

Preoperative Suggestion

I am going to make you sleepy now. I want you to think about a pleasant vacation you would like to have as you drift off to sleep.

Appendix C

Guidelines for Postoperative Interview

and Data Collection Sheet

(Partially taken from Liu, et al., 1991)

1. What was the last thing you remember before you went to sleep for your operation?

2. What is the first thing you remember after your operation?

3. Can you remember anything in between these two periods?

4. Did you dream during your operation?
   If "yes" what did you dream about?

5. What was the worst thing about your operation?

Age	Surgical procedure	
Height	Anesthetic time	
Gender	ASA Status	
Weight	Control Group	Experimental Group

Appendix D

Protocol

Control Group

Induction Period:

1. Preoxygenation for two minutes with six liters of oxygen.
2. Lidocaine 1.5 mg/kg. Propofol 2.5 mg/kg. Fentanyl 2.5 mcg/kg.
3. Facilitation of intubation with either succinylcholine 1.5mg/kg. preceded by d-Tubocurarine 0.06 mg/kg. or Vecuronium 0.1mg/kg.

Maintenance of Anesthesia:

1. N20 at 3 liters per minute and Oxygen at 1.5 liters per minute.
2. Isoflurane vaporized to maintain autonomic control of blood pressure and heart rate at ± 20% of baseline.
3. If NMB needed Vecuronium 0.05 mg/kg initially, followed by 0.01 mg/kg. to maintain NMB at 90% of base line.
4. Fentanyl 50 mcg doses to supplement analgesia.

Discontinuation of Anesthesia:

1. If NMB used, reversal with Glycopyrolate 70 mcg/kg. and Neostigmine 0.05 mg/kg.
2. Discontinuation of Isoflurane at onset of skin closure.
3. Discontinuation of N20 at completion of skin closure.

4. Oxygen at 8 liters per minute.

Experimental Group

1. Anesthetic technique for the experimental group will be the same as the control group with the exception that the preoperative suggestion will be given prior to the administration of Fentanyl during the induction period.

Appendix E

THE UNIVERSITY OF TENNESSEE
MEDICAL CENTER AT KNOXVILLE

• *University Memorial Hospital*
• *Graduate School of Medicine*

Office of Institutional Review Board
1924 Alcoa Highway
Knoxville 37920-6999
(615) 544-9781

February 16, 1995

Freddie White
Department of Anesthesia
University of Tennessee Medical Center
at Knoxville
1924 Alcoa Highway
Knoxville, Tennessee 37920

RE: **Protocol #0540 "Incidence of Induced Intraoperative Recall with a Preoperative Suggestion in Patients Receiving General Anesthesia"**

Dear Mr. White:

Your above referenced research study has been administratively reviewed and approved.

Your research application will be reviewed in one year, and you are reminded that you have individual responsibility for reporting to the committee in the event of any adverse reactions of the study.

We appreciate your informing us of this project.

Sincerely,

Joseph E. Fuhr, Ph.D.
Chairman, Institutional Review Board

JEF/rsr

Vitae

Freddie White was born in Blytheville, Arkansas on February 17, 1961. He atteneded elementary and high school in Gosnell, Arkansas. He attended Mississippi County Community College from 1978 to 1981 and received an Associate of Science Degree in Nursing. In 1988 he completed his Bachelor of Science Degree in Nursing from Maryville University St. Louis. In September 1993, he began work toward a Master of Science in Nursing, with a focus on Anesthesia. Degree requirements were completed in August 1995.